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ENTAILMENT RULES IN SEMANTIC THEORY.

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THE SPECIFIC FAILINGS ARE DISCUSSED IN THE SEMANTIC THEORY OF KATZ AND FODOR PROPOSED WITHIN CHOMSKY'S CURRENT TRANSFORMATIONAL FRAMEWORK. THE FIRST DEALS WITH THE SO-CALLED "RELATIONAL" CONCEPTS. FOR EXAMPLE, IT IS NOT EASY TO SEE HOW ANY SLIGHT MODIFICATION OF THE NOTION OF "SEMANTIC FEATURE" CAN LEAD TO THE CORRECT INTERPRETATION OF COMPARATIVE SENTENCES. THE SECOND IS THAT "ENTAILMENT RULES" ARE NOT PROVIDED, WHICH OPERATE IN THE FOLLOWING WAY--THERE IS A SENTENCE WHICH CANNOT BY ITSELF BE INTERPRETED BY THE ORDINARY SEMANTIC RULES. BASED ON THE GRAMMATICAL STRUCTURE OF X, THE ENTAILMENT RULES WILL CONVERT X INTO A SET OF SENTENCES Y SUCH THAT EACH OF THESE SENTENCES CAN BE INTERPRETED BY THE ORDINARY SEMANTIC RULES. EXAMPLES OF SITUATIONS IN ENGLISH CALLING FOR ENTAILMENT RULES ARE GIVEN, NAMELY (1) THE USE OF VERBS LIKE "KNOW," "REALIZE," AND "BE AWARE," (2) USES OF THE WORD "EVEN" IN SIMPLE ASSERTIONS AND COMPARATIVE CONSTRUCTIONS, (3) THE VARIOUS TYPES OF CONDITIONAL SENTENCES, AND (4) THE SEMANTIC PROPERTIES OF PAIRS OF WORDS LIKE "COME" VERSUS "GO," AND "BRING" VERSUS "TAKE." THE CONCLUSION THAT A SEMANTIC THEORY NEEDS AT LEAST SOME RULES OF THE ENTAILMENT TYPE HAS INTRODUCED AN IMPORTANT CONSIDERATION IN THE PERFORMANCE OF SEMANTIC ANALYSIS. THIS ARTICLE APPEARS IN THE OHIO STATE UNIVERSITY RESEARCH FOUNDATION PROJECT ON LINGUISTIC ANALYSIS, REPORT NUMBER 10. (IT)

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ENTAILMENT RULES IN A SEMANTIC THEORY

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NOTES

1. This study was conducted within the Project on Linguistic Analysis, supported by the National Science Foundation and the Office of Naval Research. In writing this paper, I received much encouragement and help from William S-Y. Wang. In our discussions, he suggested the important difference between contrastive and emphatic stress. The result is Section II of my paper. For this, I want to express my deep thankfulness to him. I also benefited by discussing the problem presented here with Charles J. Fillmore, Anne Hashimoto, and especially with Sandra Annear whose critical viewpoints toward my approach greatly stimulated my thinking. Finally I want to thank Terence Langendoen for his valuable comments and suggestions after reading my paper.

2. 'English Stress' was published in Language Learning Vol. XII No. 1, pp. 69-77. See the bibliography therein for studies relevant to the present problem.

3. I first used "one" to replace "a" when the latter is stressed. Dr. Langendoen suggested "a single" would sound better than "one" especially in a negative sentence, so both are included here.

4. See Noam Chomsky's Syntactic Structures pp. 65-7.

5. See Noam Chomsky's Syntactic Structures pp. 61-2.

6. See William S-Y. Wang's "Two aspect markers in Mandarin," to appear in Language, September 1965.

ENTAILMENT RULES IN A SEMANTIC THEORY

C. J. Fillmore

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Occasionally during the past two or three decades descriptive linguists have asked themselves such questions as "What is the role of meaning in linguistic analysis" and "What can linguistics contribute to our understanding of meaning?" The answers that have come up have generally been quite unencouraging. The answer to the first has usually been that meaning should have no role in making decisions in linguistic analysis, but, regrettably--our science is young--there are still many areas where meaning is called on to help us out. To the second question the answer has been that linguistics should be able to tell us something about meaning, but regrettably--our science is young--it hasn't really succeeded in doing so yet.

There have been times, however,--after making it clear that he was no longer talking as an "objective scientist"--when the descriptive linguist allowed himself to tell amusing anecdotes about semantic change or to describe interesting differences in the organization of concepts in different languages. And in such areas as systems of kinship terms--where, of course, he had a lot of help--he may even have been able to speak somewhat precisely.

With these last activities as exceptions, the area of semantics was generally turned over to philosophers, psychologists and cultists--people who were able to make precise and self-consistent observations about languages which nobody spoke, or to tell us amusing and revealing things about arbitrarily chosen words in some of the languages that people do speak.

Today, however, the picture has changed, largely because of the appearance of new conceptions in the theory of grammar. While the descriptive linguist conceived of his task as that of providing efficient procedures for labeling utterance segments and archiving utterances, the grammarian of today is interested in characterizing the ability of a speaker of a language to produce the sentences of his language and to perceive their grammatical structure. Semantic theories are now being constructed--based largely on the work of Noam Chomsky and Jerrold Katz

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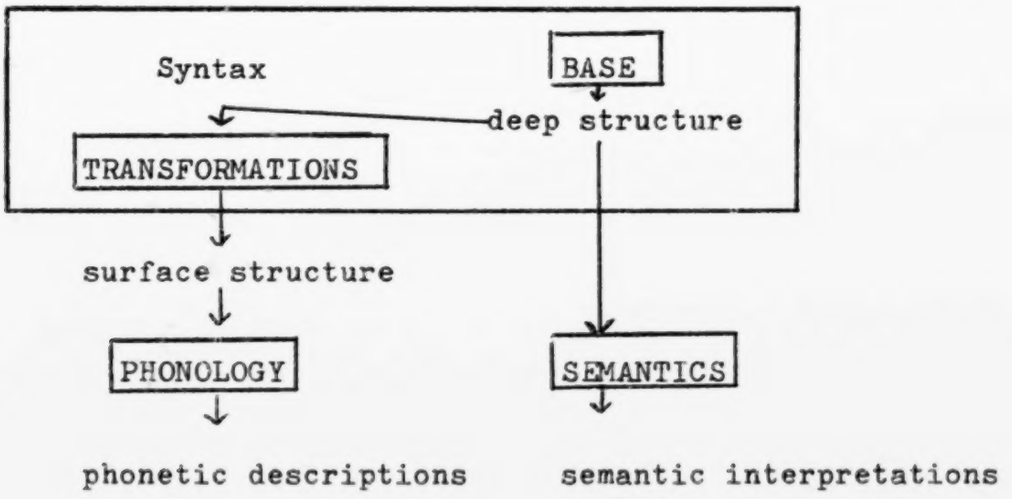
--in an attempt to characterize the ability on the part of speakers of a given language to assign semantic interpretations to sentences whose grammatical structure they perceive.

Various attempts are being made to integrate Chomsky's current version of grammar with the semantic theory of Katz and Fodor. A schema for one reasonable version of this integrated theory is given in Figure 1.



As is shown in the schema, the syntactic portion of a grammar contains two components, a base component and a transformational component. The base component specifies the underlying abstract forms of sentences--the so--called "deep structures"--and the transformational component converts these into forms directly related to actual utterances--the so-called "surface structures". The surface structures are mapped, by the phonological rules, into instructions for pronouncing the utterances.

The deep structure representation of a sentence is a string of lexical items organized to reveal grammatical categories (e.g. 'noun'), grammatical relations within the sentence (e.g. 'subject'), as well as the transformational structure of the sentence. That is, the grammatical base contains the recursive devices that account for the structure of complex and compound sentences, and introduces "markers" of the various sentence types--negative, passive, imperative, question, and the like. Each lexical item in the deep structure has associated with it, furthermore, both an assembly of semantic features corresponding to each possible

reading (each sense) of the item, and a statement of the conditions under which each of these readings is selected.

A semantic theory, in this view, provides a system of rules for projecting from the deep-structure representation of sentences to one or more semantic interpretations, matching, if it is correct, the judgments of the speakers of the language. The capabilities of such a semantic theory can be summarized as follows:

FIRST: Such a theory will assign identical semantic interpretations to synonymous expressions. For example, if the two sentences " The oculist is ill" and "The eye-doctor is sick" are synonymous, this fact will be revealed by a semantic theory which automatically assigns the same semantic interpretation to each of them. (Notice that because a system of semantic features has been posited, it is now possible to consider the existence or non-existence of cases of synonymy as an empirical question. In certain previous conceptions of synchronic linguistics it was necessary to begin by assuming the non-existence of exact synonyms. Now, however, the analyst is not free to decide in advance that there are no synonyms--this has become something which he needs to find out.)

SECOND: Within such a theory, those areas of vocabulary containing autonymous pairs of expressions will be identifiable in terms of the assignment of semantic features to lexical items. If several pairs of lexical items differ in only one pair of features, being otherwise identical, these pairs belong to a set of antonym pairs. As an example, pairs of words differing only in the selection of features identifying sex make up such a set--pairs like bull/cow, uncle/aunt, bachelor/spinster, etc.

THIRD: Such a theory provides for the context resolution of ambiguity. The conditions for interpreting each lexical item will determine which of several senses is appropriate in a given context. By consideration of these conditions, the semantic features of the verb "bark"--identifying, say, an activity of certain kinds of mammals--will, in a sentence like "The seal barked", rule out all but the "beast" interpretation of the polysemous word "seal". Similarly, that sense of "entertain" that involves feeding

and singing songs to is disallowed in the expression "to entertain questions," because the word "entertain" in that sense requires an object which is semantically marked for animateness.

FOURTH: Such a theory will provide ways of characterizing analyticity of sentences. A sentence will be judged analytic, for example, if the semantic interpretation of the predicate is wholly contained in that of the subject. ("My father is a man.") A sentence with a relative clause on one of its nouns is analytic if the semantic interpretation of the sentence without the relative clause is wholly contained in the semantic interpretation of the relative clause. ("The people who speak English speak a language.") A conditional sentence is analytic if the semantic interpretation of the consequent is wholly contained in that of the antecedent. And so on.

FIFTH: The deviance of semantically anomalous sentences will be marked, and the basis of their deviance will be accounted for. For instance, if a sentence like "My lap itches" is semantically deviant, a semantic theory will be expected to point out that while the verb "itch" requires a subject that can be interpreted as a body part, the noun "lap" cannot be so interpreted.

These remarks, I believe, fairly adequately represent the capabilities claimed for the Katz and Fodor semantic theory. For anyone interested in a discussion of the formal properties of such a theory and suggestions on the precise formulation of semantic rules, I refer you to the article by Jerrold Katz and Jerry Fodor called "The structure of a Semantic Theory" in the anthology edited by Jerry Fodor and Jerrold Katz called <u>The Structure of Language</u>.[1]

Now without suggesting that Katz and Fodor are unaware of its general inadequacies, I would like to discuss two specific failings of the theory--touching on one of them very briefly, dwelling at some length on the other.

The failure of this theory that comes most quickly to mind--and I am not the first to point this out--has to do with the interpretation of the so-called "relational" concepts. Briefly, it's not easy to see how any slight modification of the notion of "semantic feature" can lead to the correct interpretation of comparative sentences. In a sentence like "John is taller than Bill," a relation--an asymmetric relation--is understood to hold between John and Bill with respect to a certain dimension, namely height. The way in which the Katz and Fodor theory can be extended to take care of such relations is not obvious.

There seem to be semantic anomalies involving relational terms. I would insist, for example, that a sentence like "I am two years older than my father" is semantically odd. The deviance can be accounted for in some such way as the following: In the expression "my father", an asymmetric relation of precedence in time (among other things) is expressed between two objects. The comparative expression "older than" states another relation of precedence in time between the same two objects, and this relation is the reverse of and is incompatible with the first. Hence the anomaly.

The bizarreness of the sentence "I am two years older than my father" is quite different from whatever it is that's odd about "My father is two years older than I am." If you hear the latter sentence, you may not believe it, or you may suspect that it was spoken by, say, a cat. But semantically, there is nothing wrong with it.

Another problem connected with relational concepts was pointed out by Sapir in his paper on "Grading". It has to do with the interpretation of relational concepts in which the second term of the relation is not expressed. The problem has been particularly puzzling to linguists who have sought simple-minded relations between morphemes and semantic units, because while "taller" is morphologically the adjective "tall" plus the comparative suffix "er", semantically the relational notion "taller than" is more basic than the notion "tall".

It seems to me that for a semantic theory to give a correct account

of relational concepts we should expect the following:

FIRST: The theory will initially assign a relational meaning to words like "tall". (Notice, however, that a sense relating only to the dimension 'height' will also be needed for "tall"--but not for "short"--as is seen in the way we understand such expressions as "six inches tall" or "this tall".)

SECOND: The theory will interpret such words by finding, in the grammatical context, the two terms of the relation, and it will record this relation, in some way, as part of the interpretation of the sentence. One function of the comparative construction is to make the two terms of such a relation accessible.

THIRD: In those cases where the sentence does not contain a second term for the relation, the semantic theory will provide one, say the word "average."

Thus, "John is taller than Bill" will be taken care of in the first way, with "John" identified as the first term of the relation, "Bill" as the second. The sentence "John is tall", on the other hand, will be interpreted as "John is taller than average." In the sentence "John is tall", or "John is taller than average," the 'universe of discourse' of the word "average" is unspecified. There are, however, grammatical ways of identifying a universe-of-discourse for this word--as in a sentence like "He's tall for a pygmy."

A second type of semantic observation not provided for by the Katz and Fodor theory needs to be handled by what I call "entailment rules." If we call the rules provided by the Katz and Fodor theory, together with the rules I suggested for relational concepts, the "ordinary" semantic rules, entailment rules can be described, roughly, as operating in the following way: There is a sentence X which cannot by itself be interpreted by the ordinary semantic rules. Based on the grammatical structure of X, the entailment rules will convert X into a set of

sentences[2] Y such that each of these sentences can be interpreted by the ordinary semantic rules. The semantic interpretation of the set of sentences Y, then, is provided as the semantic interpretation of the sentence X.

The semantic observations for which I will propose entailment rules will tie in with the observations on relational concepts at two or three points--the first being that the translation from "John is tall" into "John is taller than average" is perhaps best interpreted as resulting from an entailment rule.

As a first example of a situation calling for entailment rules, let us consider the way in which verbs like "know", "realize" and "be aware" are used in English. What difference, for example, do you perceive in the two sentences "I think that John is sick" and "I know that John is sick"? When I ask this question of my students, I am usually told at first that the difference relates to intensity of belief, degree of confidence, or the like. That this seems plausible at first is accounted for by the fact that in these sentences the subject is the speaker and the time of the sentence is the time of the utterance. When these features are varied, the important difference between these two verbs can be more adequately perceived.

Consider, for example, the third-person-subject sentences "Bill thinks that you were here" and "Bill knows that you were here." It's fairly clear, I think, that in these sentences we are not merely being told two different things about Bill. When used appropriately, the sentence "Bill knows that you were here" entails the sentence "You were here." The sentence with "thinks" does not.

This observation on "know" as compared with "think" accounts for the fact that "John thinks that he is a girl" is not semantically odd, while "John knows that he is a girl" is. "John knows that he is a girl" is semantically odd because it entails the semantically odd sentence "He is a girl."

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[2]Perhaps the word 'proposition' should be used instead of 'sentence'. It is not necessary to an understanding of entailment rules that the elements of Y be realizable as sentences.

The nature of the entailment rule for "know" can also be seen by varying the tense of the verb. If I say, for example, that "I thought Paris was the capital of Sweden," I am revealing only my past ignorance of geography. If I say "I knew that Paris was the capital of Sweden," I am also revealing my present ignorance, in spite of the past tense of the verb. That is because the sentence with "know" entails the sentence "Paris is the capital of Sweden."

The entailment rule for "know" can be formulated as follows:

$$X - V_k - \text{that} - \underline{S} - Y \quad \underline{\text{entails}} \begin{cases} X - V_k - \text{that} - \underline{S} - Y \\ \underline{S} \end{cases}$$

We recognize, first, a class of verbs V_k, a class including "know," "realize," and "be aware," but not including "think," "believe," or "be sure". The rule (which cannot be re-applied) states that the sentence embedded after V_k is entailed.

Notice that the rule refers only to the presence of a V_k, not to other grammatical properties of the sentence. This reflects the fact that the entailment is unchanged even when the verb itself is negated or questioned or the like. That is, I, the speaker, am claiming that "Bill is here" in all of the following sentences: "He doesn't know that Bill is here." "Does he know that Bill is here?" "Doesn't he know that Bill is here?"

(Before I leave the discussion of "know", I should say that in addition to the entailment difference, there is also a difference between "know" and "think" that <u>does</u> have to do with degree of confidence. I would say that apparent counterexamples of the rule for "know" are really instances of 'playing' with the word "know". This kind of play is indulged in, for instances, in certain cases where the entailed sentence is known to be false. There is a way of saying "I just <u>knew</u> Goldwater was going to get elected" where the meaning of complete confidence is conveyed in spite of the obvious falsity of the entailment.)

The next two examples of entailment situations involve uses of the word "even"--one in simple assertions, the other in comparative constructions. Consider the difference between the sentences "She reads

Sanskrit" and "She even reads Sanskrit". The second tells us the same as the first, but it adds that this fact is somehow surprising. The contribution of the word "even" cannot be explained, it seems to me, by assigning it semantic features of the usual kind. I would say that the sentence "She even reads Sanskrit" is to be 'factored', so to speak, into two sentences, namely "She reads Sanskrit" and "One would expect that she does not read Sanskrit." One of the entailment rules in a semantic theory of English will carry out this 'factoring' operation.

Looking at another use of "even," consider the two sentences "John is taller than Bill" and "John is even taller than Bill." In the first sentence, John and Bill may both be giants or midgets--only their relative height is in question. In the second sentence, the presence of "even" entails that Bill is tall. I would say that "John is even taller than Bill" entails the two sentences, "John is taller than Bill" and "Bill is tall." Recall that "Bill is tall," now, is to be interpreted as "Bill is taller than average."

To avoid giving the impression that we have to invent entailment rules for every situation in which the truth or appropriateness of one sentence is involved with the truth or appropriateness of other sentences, it may be wise to insert a brief 'aside' at this point to consider those many cases of inter-sentence inferences--or what have you--which are <u>not</u> to be handled in this way.

As our first example, we may consider the relation which holds between such sentences as "My parents were born in Sweden" and "My father was born in Sweden." The second is surely true whenever the first is true, but this is not something calling for the construction of an entailment rule. Relations of 'class inclusion' between lexical items may be quite adequately expressed within the limitations of the Katz and Fodor theory. The relationship between the two sentences, therefore, can be observed by simply comparing their semantic interpretations. The meaning of "father" includes the meaning of "parent." There is no need to introduce <u>rules</u> to express this relation over again.

Secondly, consider the two sentences "He is John's brother" and "John has a brother." It is obvious that the second sentence must be true whenever the first has been used appropriately, and it is true that this relationship is grammatically statable and could be formulated as an entailment rule. However, there are fairly convincing reasons for regarding the sentence "John has a brother" as the transformational source of the noun phrase "John's brother." A semantic theory operates on the deep structure of sentences; the deep structure of the sentence "He is John's brother" contains as one of its parts the sentence "John has a brother." There is no reason for a semantic theory to express, by means of a separate set of rules, the relation between a sentence and its transformational sources. The grammar of the language has already done that.

A third type of inferences from one sentence to other sentences may be accounted for by referring to the speaker's and hearer's shared knowledge of the conditions under which anaphoric processes take place. As an illustration of this, consider the sentence "He doesn't swim, either." From the stressed pronoun and the word "either", one who knows English can infer that one male human fails to swim, and that at least one additional being fails to swim.

Now instead of saying that the information that somebody else doesn't swim is part of the meaning of "He doesn't swim, either, "I would rather say that what we have here is--in a sense--an incomplete sentence and that the hearer knows what is necessary to complete it. A linguistic description of a language accounts for independently interpretable sentences. It does not account directly for a sentence like "He doesn't swim, either", but only for the larger sequences of which this can be a part. In the deep structure of these larger sequences, the information about someone else's inability to swim had to be explicitly present.

A final type of inter-sentence relationship that might be confused with the situation I am trying to deal with is what John Austin called "implications." An example of an implication, in Austin's sense,

is seen in the relation between the two sentences, "John is sick" and "I believe that John is sick." Here it's not utterances in isolation that are being examined, but the utterance "John is sick" on the part of a particular speaker at a particular time and the assumption that if the sentence had been used appropriately, it would also have been appropriate for the same speaker at the same time to have said, "I believe that John is sick."

This is more like an assumption of "good faith" that underlies speech communication in general than something which a semantic theory needs to explain. An assumption like this certainly need not be stated in the form of a rule which relates sentences to other sentences.

Now, class-inclusion relations, we have seen, can be taken care of in a Katz and Fodor semantic theory as presently conceived. The relation between a sentence and its transformational sources is made explicit in the grammar. Certain sentences are best thought of, from the point of view of an integrated theory of linguistic description, as incomplete sentences; semantic theory is to be held responsible only for independently interpretable sentences. And certain assumptions about the non-abuse of speech communication are <u>too</u> general to require expression in the form of semantic rules. These four situations present no problems to semantic theory, it is clear, but I believe the observations we came across in connection with the two uses of "even" do not fall into any of these types. I am convinced, therefore, that an adequate semantic theory needs to incorporate an essentially new type of rule to account for these observations.

Let's return now to the first observation on the word "even," and recall that the sentence "She even reads Sanskrit" entailed "One would expect that she does <u>not</u> read Sanskrit." If the original sentence had been, "She doesn't even read Sanskrit," the entailed sentence would have been "One would expect that she <u>does</u> read Sanskrit." It is true here and with several of the other entailment rules that we'll see, that if the original sentence is negative, one of the entailed sentences is positive; if the original sentence is positive, the entailed sentence

is negative. This property I shall call 'sign-changing', and I'd like to deal with it by abstracting from the sentences the grammatical properties 'negativity/positivity', representing them in the rules with a variable 'α'. In a single entailment rule, then, if 'α' has one of these values, '$-\alpha$' has the other. Using this notation, our first observation on "even" can be formulated in some such way as the following:

α(NP+even+Aux+VP) entails $\begin{cases} \alpha\text{(NP+Aux+VP)} \\ \text{One would expect that } (-\alpha\text{(NP+Aux+VP)}) \end{cases}$

The entailed proposition can be represented more abstractly if 'expectation' can be presented as a modality on an entire sentence and if the syntactic element Aux (verbal auxiliary) can be considered as the first constituent of the remainder of the sentence. Our rule, now, can be rewritten as

α(Aux(NP+even+VP)) entails $\begin{cases} \alpha\text{(Aux(NP+VP))} \\ \text{expectation } (-\alpha\text{(Aux(NP+VP))}) \end{cases}$

A second example of a sign-changing rule involves the prepositional phrase which provides the 'universe of discourse' for interpreting relations whose second terms are unexpressed, as, e.g., in "He's tall for a pygmy." These "for"-phrases actually, however, do more than just that. If I say of someone that "She's smart for a girl," I am not telling you only of her rank among girls with respect to smartness--I have included a commentary on girls, namely that they are not as a rule smart. If I had said, "She's not smart for a girl," I would have been implying that girls are smart. "She's smart for a girl" entails "Girls are not smart." "She isn't smart for a girl" entails "Girls are smart." Another sign-changing rule.

But now let's notice what happens when sentences of this last type contain the word "even". While "She's smart for a girl" entails that girls are not smart, "She's even smart for a girl" entails that girls are smart. What seems to be happening is that the word "even" calls into play a sign-changing rule which has the effect of reversing the sign of the entailment for the "for"-phrase. "She's even smart for a girl" entails that girls are smart. "She isn't even smart for a girl"

entails that girls are not smart. This is a case where two sign-changing rules result in an entailed sentence that retains the sign of the original sentence.

An abundant source of entailment observations is supplied by the various types of conditional sentences. The rules for conditional sentences reveal some of the advantages of isolating the tenses and modalities from the remainder of the sentence, because semantically these features are associated with the conditional sentence as a whole, not with each clause separately. For one thing, conditional sentences are themselves essentially timeless. The auxiliaries in these sentences relate to the difference between neutral and counterfactual conditionals and to the time at which or during which the conditional relation is understood to hold, not to temporal aspects of the propositions contained in the conditional. We can represent the abstract structure of a neutral conditional sentence in such a form as

$$\text{tense}\ (p \supset q)$$

where the 'horseshoe' is to be read as, say, 'results in', in order to remind ourselves that the conditional relation of English is not that of material implication.

Thus, we could represent the neutral conditional sentence "If John comes, I go" as

$$\text{general}\ (\text{John come} \supset \text{I go})$$

or the sentence "If John comes, I'll go" as

$$\text{future}\ (\text{John come} \supset \text{I go}).$$

I assume that the underlying grammatical structure of counterfactual conditionals will have some kind of a marker for identifying them as such. This marker will have the two-fold role of (a) triggering the transformations which provide counterfactual conditionals with the correct pair of auxiliaries ("If John were here, I would go," "If John had been here, I would have gone," etc.) and of (b) triggering the entailment rule which adds to the meaning of the conditional a sign-changed version of the antecedent--that is, which provides the information that the antecedent is false.

From the structure underlying "If John were there, I would go," the entailment rules in question would give us

present (John be there ⊃ I go)
negative (present (John be there));

and from "If John were not there, I would go" they would give us

present ((negative (John be there)) ⊃ I go)
positive (present (John be there));

and, to include an example of a past tense counterfactual conditional, we can see that "If John had come, I would have gone" entails

past (John come ⊃ I go)
negative (past (John come))

Conditional sentences the antecedents of which begin with "if only" entail a neutral conditional plus an optative comment on the antecedent. That is, "If only John comes, I'll go" entails

future (John come ⊃ I go)
optative (future (John come))

Conditional sentences whose antecedents begin with "even if"--the so-called 'concessive conditionals'--do not entail any actual conditional relations, but only, first, an expectation that a conditional relation holds, second, a denial of that conditional relation, and third, the information that the consequent is true. The 'expected' conditional has as its consequent a sign-changed version of the original consequent.

For example, "Even if John comes, I'll go" entails

expectation (future (John come ⊃ negative (I go)))
negative (future (John come ⊃ negative (I go)))
future (I go)

Applying these relations to another example, we can see that the sentence, "Even if John doesn't come, I won't go" entails

expectation (future (negative (John come) ⊃ I go))
negative (future (negative (John come) ⊃ I go))
negative (future (I go))

Recall now that in the analysis of conditional sentences we have found two sign-changing rules, one affecting the antecedent, and one

affecting the consequent. Since it's possible to have both of these phenomena operating in the same sentence, a sentence like "Even if John had come, I would have gone" entails four things: (a) One would expect that John's coming would result in my not going. (b) It is not true that John's coming would result in my not going. (c) John did not come. and (d) I went. A sign-changed version of the consequent is found in the expected and denied conditional associated with "even"; a sign-changed version of the antecedent is found in the counterfactual entailment.

The result of applying entailment rules operating on past-tense counterfactual concessives can be formulated--this time by using two positivity/negativity variables, $\underline{\alpha}$ and $\underline{\beta}$--as follows:

even+if($\underline{\alpha}$(past+have+en(NP+X))), $\underline{\beta}$(past+will+have+en(NP'+Y))[3]

entails

i) expectation (past (($\underline{\alpha}$(NP+X)) $\supset$ -$\underline{\beta}$(NP'+Y)))
ii) negative (past(($\underline{\alpha}$(NP+X)) $\supset$ -$\underline{\beta}$(NP'+Y)))
iii) -$\underline{\alpha}$(past (NP+X))
iv) $\underline{\beta}$(past (NP'+Y))

Where both clauses are positive, we get:

even+if(positive(past+have+en(John+come))),positive(past+will+have+en(I+go))
("Even if John had come, I would have gone.")

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[3]The form of the Aux is given here in detail, although it is assumed that the deep structure of conditional sentences will specify, for the entire sentence, only the tense and whether it is counterfactual or neutral.

entails

i) expectation (past ((positive (John come)) ⊃ negative (I go)))
("One expects that John's coming would have resulted in my not go

ii) negative (past ((positive (John come)) ⊃ negative (I go)))
("It is not true that John's coming would have resulted in my not going.")

iii) negative (past (John come))
("John did not come.")

iv) positive (past (I go))
("I went.")

Where both clauses are negative we get:

even+if(negative(past+have+en(John+come))),negative(past+will+have+en(I+go)
("Even if John hadn't come, I wouldn't have gone.")

entails

i) expectation (past ((negative (John come)) ⊃ positive (I go)))
("One expects that John's not coming would have resulted in my going.")

ii) negative (past ((negative (John come)) ⊃ positive (I go)))
("It is not true that John's not coming would have resulted in my going.")

iii) positive (past (John come))
("John came.")

iv) negative (past (I go))
("I didn't go.")

Where only the antecedent is negative, we get:

even+if(negative(past+have+en(John+come))),positive(past+will+have+en(I+go)
("Even if John hadn't come, I would have gone.")

entails

i) expectation (past ((negative (John come)) ⊃ negative (I go)))
("One expects that John's not coming would have resulted in my not going.")

ii) negative (past ((negative (John come)) ⊃ negative (I go)))
("It is not true that John's not coming would have resulted in my not going.")

iii) positive (past (John come))
("John came.")

iv) positive (past (I go))
("I went.")

Where only the consequent is negative, we get:

even+if(positive(past+have+en(John+come))),negative(past+will+have(I+go))
("Even if John had come, I wouldn't have gone.")

entails

i) expectation (past ((positive (John come)) ⊃ positive (I go)))
("One expects that John's coming would have resulted in my going.")

ii) negative (past ((positive (John come)) ⊃ positive (I go)))
("It is not true that John's coming would have resulted in my going.")

iii) negative (past (John come))
("John did not come.")

iv) negative (past (I went))
("I didn't go.")

What this discussion about conditionals means is that such notions as 'concessive' or 'counterfactual' are not primitive terms in the semantic theory but can themselves be analyzed in terms of such notions as 'conditional', 'negation', and 'expectation', all of them terms in the semantic theory which are needed on independent grounds. Our discussion could go on, showing, for example, that the types of 'provisional' relations associated with such conjunctions as 'unless' and 'provided that' may be similarly analyzed. Briefly "$\underline{\alpha}$A unless $\not\beta$B" entails "if -$\not\beta$B, $\underline{\alpha}$A" and "if $\not\beta$B, -$\underline{\alpha}$A". That is, "I'll go unless you go" is analyzed as "If you go, I won't go; if you don't go, I will go." "$\underline{\alpha}$A provided that

βB" entails "if βB, αA" and "if -βB, -αA". That is, "I'll go provided that you go" is analyzed as "If you go, I'll go; if you don't go, I won't go."

The discussion of conditional sentences may seem like little more than a complicated way of talking about things that are intuitively well understood before we start. To show how entailment rules may be called on to shed light on new problems in semantic analysis, I would like to run through a series of arguments dealing with semantic properties of the pairs of words "come" vs. "go", and "bring" vs. "take." I'm interested in these words in contexts where they are semantically paired. The expression "go to school", will therefore not be considered in this discussion; and neither will the expression "take off" meaning "remove." It is not semantically paired with "bring off."

One proposal which has been made concerning these words has it that the semantic characterization of "come" and "bring" includes a feature shared by such words as "here" and "this," while in "go" and "take" there is a feature shared by "there" and "that". The proposal is that the features of place deixis obviously found in "this" and "that" are repeated in such pairs of words as "come" and "go". The features refer to relative proximity to the speaker, with a context variant in the case of verbs of motion indicating direction toward or away from the speaker.

This interpretation appears to be supported by the way we understand such sentences as "Please bring it here," "He came here this morning," "I'll go to your house tomorrow," "I took it there," and by the fact that we reject such sentences as "Please go here" or "Please take it here."

But what do I say when somebody calls me up on the telephone and asks me over? I say, "I'll come right over," not "I'll go right over;" "I'll bring something to drink," not "I'll take something to drink."

The suggestion that the features involved are merely deictic features referring to direction of movement with respect to the speaker at the moment of speaking, thus, has to be rejected.

A second proposal might be that while "go" and "take" involve

movement away from the speaker, "come" and "bring" involve movement toward the place where the speaker will be when the action is completed. This new interpretation is supported by our earlier sentences --for example, "Please come here," "He brought it here"--and also by the troublesome sentences--"I'll bring it there" or "I'll come right over."

This proposal does nothing, however, to explain the difference between, say, "I'll bring it there" and "I'll take it there," since in both cases the speaker will be "there" after the action is completed. It is not a satisfactory account of the way we understand these sentences to say that in the one case information about the future location of the speaker is made explicit, in the other case it is not.

But a more important objection can be seen if we return to our telephone conversation. If I am not able to see my friend myself, I might get someone else to go. In such a case, I will say, "He'll come right over," or "She'll bring it to you", or the like. In these examples, the present or future location of the speaker is not involved at all.

Just to eliminate all possibilities before we resort to entailment rules, we might consider a third alternative, namely that the semantic feature common to "bring" and "come" has to do with the place where the hearer, not the speaker, will be after the action is completed. In "Please bring it here," "here" is where "you" will be after the bringing of it is done. In "I'll come to see you tonight," the "coming" is to where you will be. In "She'll bring it to you," the place to which she will bring it is the place where you will be.

Counterexamples to proposal three are easy to come by, and, in fact, have already been supplied. Claarly, in "She brought it here this morning", "your" location at that time is not in the picture at all. Equally obvious cases are those whose action involves both the speaker and the hearer. There is a difference between "Let's come to the library again tonight" and "Let's go to the library again tonight." And between "Please take me to the airport" and "Please bring me to the airport."

The fourth and final proposal is that these verbs bring into play various entailment rules--the details of which I have by no means worked out--and that, in the case of "come" and "bring", the entailments which are appropriate depend on the subject of the sentence.

Simplifying a little, I will limit the entailment observations related to these verbs to cases where the goal of movement is specified. I shall limit myself, in fact, to the cases where the goal of movement is either "here", "there," "to the airport" or "into the room". As we shall see, one of the effects of the entailment rules will be to change directional phrases such as these into the corresponding locational phrases. "Here" and "there" will be unaffected by this change, but "to the airport" and "into the room" will be changed to "at the airport" and "in the room" respectively.

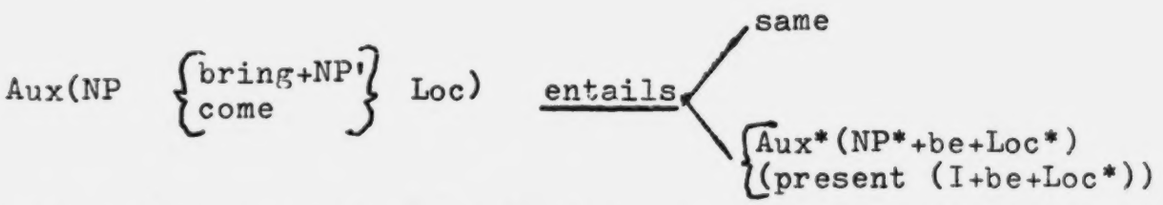
The rule for "take" and "go" is relatively simple and is not affected by the subject. The location phrase (derived from the directional phrase) in a sentence with "take" or "go" is merely a place where <u>I am not</u>. That is, in such sentences as "I'll take it to the airport," "He went to the airport," "Please take it to the airport," the entailment is that "I am not at the airport."

$$\underline{\alpha}(\text{Aux}(\text{NP} \begin{Bmatrix}\text{take+NP'}\\ \text{go}\end{Bmatrix} \text{Loc})) \quad \underline{\text{entails}} \begin{cases}\text{same}\\ \text{negative (present(I+be+Loc*))}\end{cases}$$

Now we can say that by applying this rule to the sentence "Please take it here" we get the entailed sentence "I am not here," and the semantic rules for deictic categories will mark as anomalous all present-tense copular sentences with non-matching deictic features for subject and predicate. The oddity of "Please take it here," thus, is another instance of 'secondary semantic oddity': "John knows that he is a girl" is semantically odd because the sentence it entails ("He is a girl") is odd. "Please take it here" is odd because the sentence it entails ("I am not here") is odd.

The rules for "come" and "bring," as I said, depend on the subject. Actually these verbs are ambiguous, because they involve a <u>choice</u> of

entailments, one paralleling the rule for "go" and "take" but declaring that the place mentioned in the sentence is where I am, the other being somewhat more complicated. The most general form of the rule is as follows: (the negativity/positivity value of the sentence is not relevant to this rule and is therefore left unexpressed)



(The difference between Loc and Loc* is that Loc is a directional phrase, Loc* is the corresponding location phrase. Aux and Aux* will often be identical, but 'perfect' and 'progressive' will not be present in Aux*; that is, "He is bringing it to the station" does not entail "You are being at the station" but "You are at the station." The relation between NP and NP* can be stated as follows:

NP* is "you" when NP is "I"
NP* is "I" when NP is "you"
otherwise NP* is either "I" or "you".)

Notice that if these rules are correct, "come" or "bring" sentences with "I" or "you" as subject should be capable of two interpretations, unless one or both of the entailed sentences is anomalous. Thus, "I'll come to the airport early tomorrow" entails either that you will be at the airport or that I am at the airport now. These two interpretations fit, I believe, the two possible situations in which we could use that sentence. A sentence like "I'll come there," on the other hand, permits only the entailment that you will be there because "I am there" is anomalous.

To take an example with second person subject, notice that "You came to the airport" may entail either that I am at the airport now or that I was at the airport when you came. "You came there", however, is unambiguous, because while the entailment that I was there is acceptable, the other--that I am there--is not.

When the subject is something other than first or second persons, as shown by the rule, three interpretations are possible. That is, "He

came to the airport" entails either that you were at the airport, that I was at the airport, or that I am at the airport now. All of these are acceptable.

I said that the details of these entailments were not thoroughly worked out, and that is certainly true. It is not clear to me, for instance, how the inclusive and exclusive senses of "we" are going to be taken care of. If "we" means "you and I", then "We came to the airport early today" has one interpretation. If it means "somebody else and I, but not you", it has two possible interpretations. Our theory will have to specify all three possibilities.

Another matter has to do with certain apparent differences in the applicability of these rules to "bring" and "come." You may have noticed that I used "come" in most of my recent examples. This is because there appears to be disagreement among speakers of English on certain uses of "bring." Imagine that you and I are here, and a friend of ours is in the hospital, and consider the appropriateness of my saying "Let's bring her some flowers." Many adult speakers of English would reject the sentence under these conditions, others would not. There is no such disagreement about the unacceptability, under the same conditions, of "Let's come to the hospital."

I conclude these remarks on entailments by admitting that my solutions are all extremely provisional; that I regard the positing of entailment rules as a last-resort matter; and that I have only suggested--have certainly not provided--a notation for these rules. I will be happy if any of these observations can be shown to be explainable by the 'ordinary semantic rules'. (I'll be embarrassed if they all can.)

One possible way of removing entailment rules is to invent transformational rules which, in each case, will show that the sentences I have worried about are transforms of the sentences which I said they entail. It might be possible to construct a transformation which will take the triplet of sentences "Mary is a girl", "Girls are not smart", and "Mary is smarter than the average girl" into the sentence "Mary is smart for a girl." Now we can say that the meaning of the sentence is a product of the meanings of its source sentences. The objection to this solution is

that it amounts to constructing syntactic rules for the sake of preserving a questionable notion of semantic interpretation. The claim that the semantic interpretation of a sentence is a simple product of the semantic interpretation of its constituent sentences is a claim the truth of which should be discovered, not assumed in advance. The only way to discover if this claim is true is to have autonomous criteria for syntactic analysis.

The conclusion that a semantic theory needs at least some rules of the entailment type has introduced, at least for me, an important consideration in the performance of semantic analysis. I think we should continue to ask the old questions first--(1) What is the underlying grammatical structure of this sentence? (2) What semantic features can we assign to each lexical item such that the rules for amalgamating these sets of features within each constituent will account for the semantic interpretation of the sentence?

But when, after exploring all possible answers to these questions, certain problems remain unresolved, I now ask--(3) What do sentences like these entail?

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